## Original paper

# Contribution of Demographic Variables, Parents Smoking, Anxiety, and Depression to Smoking Status and Severity of Nicotine Dependence in Emerging Adulthood (Predictors of Smoking Status and Nicotine Dependence)

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## Abstract

**Aim:** Smoking is recognized as a chronic nicotine dependence disorder that is considered a major risk factor for various diseases and disabilities affecting the physical health of all body organs, as well as mental health. Emerging adulthood is a life stage from 18 to 25 years old when most identity exploration occurs, which may include experimenting with various life possibilities, including smoking. Examine the contribution of demographic variables (age, sex, employment, financial status), parental smoking, anxiety, and depression to nicotine dependence and smoking status in young individuals. **Subjects and Methods:** A cross-sectional study was conducted, involving 139 participants aged 18 to 25 residing in the Republic of Croatia. The questionnaire consisted of three parts. The first part focused on demographic questions (age, sex, marital status, educational level, employment, financial status self-assessment, and whether participants were smokers or not), followed by the Hospital Anxiety and Depression Scale (HADS) and the Fagerström Test for Nicotine Dependence (FTND). **Results:** The results revealed a positive correlation between anxiety and nicotine dependence (p = 0.004). Significant contributions to nicotine dependence were observed from variables of anxiety (p = 0.004) and one parent smoking (p = 0.004), while the smoking status was influenced by both parents smoking (p = 0.026). **Conclusion:** The research findings emphasize the importance of addressing anxiety symptoms in efforts to prevent and reduce nicotine dependence among youth. They also highlight the need for targeted interventions aimed at re-

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ducing parental smoking to mitigate the risk of smoking initiation and the severity of addiction in children.

## Introduction

Smoking is recognized as a chronic nicotine dependence disorder that is considered a major risk factor for various diseases and disabilities affecting the physical health of all body organs, as well as mental health [1-3]. It is also notable that tobacco consumption has been associated with various psychopathological conditions in recent decades, including depression, anxiety, and attention-deficit/ hyperactivity disorder [4-6].

Emerging adulthood is a life stage from 18 to 25 years old, during which individuals do not see themselves as adolescents, but many also do not view themselves entirely as adults [7]. Most identity exploration occurs during emerging adulthood rather than adolescence [7]. Identity formation involves experimenting with various life possibilities and gradually moving toward making lasting decisions. Smoking may be associated with specific social circles, lifestyles, or personal beliefs and young people may try smoking to fit in or stand out in these circles. This encompasses exploring one's identity about self-perceptions regarding smoking behaviour. In young adulthood, a stronger self-identification as a smoker was linked to a greater increase in smoking behaviour [8]. Since the brain is still in a continuous development phase during emerging adulthood, and nicotine affects the brain's reward system and regions associated with emotional and cognitive functions, research suggests that changes induced by nicotine in these brain areas during this life period may contribute to the continuation of tobacco use into adulthood [9,10].

According to the ESPAD study in 2015, 62 % of fifteen-year-olds in Croatia (61 % of boys and 63 % of girls) had smoked once or more in their lifetime. Smoking among students has shown a declining trend both in Croatia and in Europe in the prevalence of smoking among students from 1995 to 2015. In European countries, 67 % of students smoked in 1995, and in 2015, it was 47 %, while in Croatia, 69 % of students smoked in 1995, and in 2015, it was 62 %, keeping us still above the European average [11,12].

The initiation of smoking at this age is a notable concern because tobacco use is primarily established during adolescence, and research suggests that approximately 50 % of individuals who start smoking during their adolescent years continue the habit for 15 - 20 years [13]. Even occasional cigarette consumption at this age can lead to a faster progression of nicotine dependence and neurophysiological dependence on nicotine [14].

Despite having information about the consequences, the global number of smokers continues to rise, especially in developing countries [15]. This suggests that awareness of these outcomes does not lead people to quit smoking permanently, nor does it deter new smokers from adopting the habit.

Several predictors of smoking status provide insight into factors that might be alterable for potential cessation strategies. Various studies have examined factors contributing to smoking status and have identified several of them [16,17]. For example, smoking is more prevalent among less educated individuals, females, individuals with lower parental education, alcohol consumption, and a higher proportion of smokers in cases where parents smoke [18-21]. Smoking is also linked to socio-economic status, including education, showing a higher prevalence among individuals with lower levels of education [22]. Furthermore, smoking patterns vary by race, with some non-White ethnic groups showing higher prevalence rates [23]. Some studies also suggest the intergenerational transmission of nicotine dependence, where children of smokers are more likely to become regular smokers compared to those with non-smoking parents [24,25].

However, it is essential to distinguish between nicotine dependence and smoking behaviour. Smoking behaviour is an observable indicator of tobacco consumption, while nicotine dependence is a concealed concept that reflects the extent of psychological and/ or physiological addiction to nicotine [26]. Through research, various factors have been identified as potential influencers of the severity of dependence. Some of the factors include anxiety and depressive mood. Several studies have indicated that both have an impact on the severity of nicotine dependence. Research suggests that individuals with more depressive symptoms and those with higher levels of anxiety tend to have more severe nicotine dependence [27-34].

The self-medication hypothesis proposes that individuals with such symptoms smoke as a means to alleviate or alleviate neurocognitive deficits and symptoms. Considering all the factors mentioned, it is crucial to identify predictive factors that contribute to nicotine dependence and smoking status among young people. Recognizing these risk factors can facilitate preventive measures. The aim of this research was to investigate the contributions of demographic variables (age, sex, employment, financial status), parental smoking, anxiety, and depression to nicotine dependence and smoking status in young individuals.

## Subjects and Methods

A cross-sectional study was conducted, involving 139 participants aged 18 to 25 residing in the Republic of Croatia. The

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research took place from January to April 2023, utilizing an online anonymous questionnaire created through Google Forms.

A total of 219 individuals filled out the questionnaire; after excluding those older than 25 and younger than 18, 139 participants remained. In the surveyed sample, the median age of participants was 22 years (IQR from 21 to 24). There were 70 smokers in the sample (50.4 %), with 41 (29.5 %) being male and 98 (70.5 %) female. Regarding educational attainment, the majority had completed vocational school (87 participants, 62.6 %). Financially, 83 participants (59.7 %) assessed their status as good. The majority resided in urban areas (62.6 %), with 85 (61.2 %) employed, and 61 (43.8 %) of them having one smoking parent.

Before accessing the survey, participants were briefed on the principles (voluntariness, anonymity), purpose, and objectives of the research, and they had to provide anonymous voluntary consent to participate, with no collection of personal data during the study. To prevent multiple responses from the same participant, they had to register with their email address, which was not collected as part of the data. Participants were also informed that they could withdraw at any time by exiting the browser. It took approximately 5 – 10 minutes to complete the questionnaire.

The questionnaire consisted of three parts. The first part focused on demographic questions, consisting of seven items, including questions about age, sex, educational level, employment, financial status self-assessment, and whether participants were smokers or not.

Tools used were: 1. Hospital Anxiety and Depression Scale (HADS) and 2. Fagerström Test for Nicotine Dependence (FTND). HADS comprised 14 items, with 7 related to depression and 7 to anxiety. Responses were on a Likert scale from 0 to 3. The total score was the sum of all responses. The reliability expressed by Cronbach's alpha coefficient was 0.78 for the anxiety subscale and 0.86 for the depression subscale [35].

FTND consisted of six items assessing quantity, compulsion, and dependence. The total score was the sum of all responses, and a higher FTND score indicated a higher degree of physical dependence. The questionnaire was free to use. The reliability expressed by Cronbach's alpha ranged from 0.45 to 0.83 [36].

Descriptive statistical methods were used to describe the frequency distribution of the investigated variables. Mean values were expressed by the median and interquartile range. The Kolmogorov-Smirnov test was employed to test the normality of the distribution. The Mann-Whitney test was used to analyse the difference between two independent variables. Spearman and Point Biserial correlations were used to investigate associations. Binary logistic regression (stepwise method; criteria: probability of F to enter <= 0.05; probability of F to remove >= 0.100) was employed to determine predictors of smoking status, while Linear regression analysis (stepwise method; criteria: probability of F to enter <= 0.05; probability of F to remove >= 0.100) was used to identify predictors of nicotine dependence severity. The significance level was set at $p < 0.05$. IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, USA; 2017), was used for data processing.

## Results

The results indicate a moderately positive correlation between nicotine dependence and anxiety (Spearman's correlation; $p = 0.004$), meaning that higher anxiety is associated with greater nicotine dependence. Additionally, anxiety is moderately positively correlated with depression (Spearman's correlation; $p < 0.001$), suggesting that higher anxiety is associated with higher depression (Table 1.).

**Table 1.** Correlation of Nicotine Dependence Severity with Demographic Variables, Anxiety, and Depression

|  |  | 2. | 3. | 4. | 5. | 6. | 7. |
|---|---|---|---|---|---|---|---|
| 1. Nicotine dependence | Corr. Coeff. | 0.342** | 0.184 | 0.041 | -0.093 | -0.002 | 0.086 |
|  | p† | 0.004 | 0.127 | 0.738 | 0.446 | 0.986 | 0.479 |
| 2. Anxiety | Corr. Coeff. |  | 0.467** | 0.085 | 0.009 | 0.023 | -0.130 |
|  | p† |  | < 0.001 | 0.317 | 0.921 | 0.792 | 0.126 |
| 3. Depression | Corr. Coeff. |  |  | -0.002 | 0.027 | 0.049 | -0.033 |
|  | p† |  |  | 0.981 | 0.752 | 0.564 | 0.701 |
| 4. Age | Corr. Coeff. |  |  |  | -0.071 | 0.161 | -0.012 |
|  | p† |  |  |  | 0.404 | 0.059 | 0.884 |
| 5. Sex | Corr. Coeff. |  |  |  |  | -0.087 | -0.017 |
|  | p‡ |  |  |  |  | 0.310 | 0.843 |
| 6. Place of residence | Corr. Coeff. |  |  |  |  |  | -0.058 |
|  | p† |  |  |  |  |  | 0.500 |
| 7. Financial status | Corr. Coeff. |  |  |  |  |  |  |
|  | p† |  |  |  |  |  |  |

p - statistical significance; † Spearman correlation, ‡Point Biserial correlation
* p < 0.05; ** p < 0.01

**Table 2.** Summary of Linear Regression Analysis – predictor variable nicotine dependence

|  | β | t | p | 95 % CI (β) | | AR² |
|  |  |  |  | Lower | Upper |  |
|---|---|---|---|---|---|---|
| (Constant) |  | 2.420 | 0.018 | 0.370 | 3.861 | 0.160** |
| Anxiety | 0.328 | 2.969 | 0.004** | 0.086 | 0.441 |  |
| Do parents smoke - one | -0.267 | -2.419 | 0.018* | -2.390 | -0.229 |  |

p - statistical significance; β - regression coefficient; t - the size of the difference relative to the variation in your sample data; AR2 - coefficient of determination; CI – confidence interval; † Linear regression
* p < 0.05; ** p < 0.01

**Table 3.** Association between youth smoking and parental smoking

|  |  |  | Smoker | | Total |
|  |  |  | No | Yes |  |
|---|---|---|---|---|---|
| Has anyone of your parents smoked or is smoking? | No | N (%) | 22 (57.9) | 16 (42.1) | 38 (100) |
|  | Yes, one | N (%) | 34 (55.7) | 27 (44.3) | 61 (100) |
|  | Yes, both | N (%) | 13 (32.5) | 27 (67.5) | 40 (100) |
| Total |  | N (%) | 69 (49.6) | 70 (50.4) | 139 (100) |

p - statistical significance; χ2 = Chi Sqare test; † Chi Sqare test
* p < 0.05

**Table 4.** Summary of Binary Logistic Regression Analysis – predictor variable smoker status

|  | β | Wald | p | OR | 95 % CI (OR) | |
|  |  |  |  |  | Lower | Upper |
|---|---|---|---|---|---|---|
| Do parents smoke - no |  | 6.427 | 0.040 |  |  |  |
| Do parents smoke - one | 0.088 | 0.044 | 0.833 | 1.092 | 0.482 | 2.476 |
| Do parents smoke - both | 1.049 | 4.962 | 0.026 | 2.856 | 1.134 | 7.190 |
| Constant | -0.318 | 0.939 | 0.332 | 0.727 |  |  |

β - regression coefficient, Wald - approximates the Likelihood Ratio Test; p - statistical significance; OR – Odds ratio; CI – Confidence interval
* p < 0.05

To explore predictors of nicotine dependence severity, a linear regression analysis was conducted using the stepwise method. The analysis included predictor variables such as age, sex, place of residence, assessment of financial status, employment, parental smoking, and the severity of anxiety and depression. The results revealed that significant predictors are anxiety (p = 0.004) and smoking by one parent (p = 0.018). These variables collectively explain 15 % of the variance in nicotine dependence severity (AR2 = 0.160; p = 0.001). Examining the β coefficient, it is evident that both anxiety and education level positively contribute to the severity of nicotine dependence (Table 2.).

Results have shown a significant association between youth smoking and parental smoking (χ2 test = 0.036), with a significantly higher distribution of those who smoke when both parents smoke, 27 of them (67.5 %) (Table 3.).

To identify predictors of smoking among young individuals, Binary logistic regression was employed utiliz-

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ing the stepwise method. The analysis included predictor variables such as age, sex, place of residence, assessment of financial status, employment, parental smoking, and the severity of anxiety and depression. The results revealed that significant predictor are both parents smoking (p = 0.026) compared to the reference category of non-smoking parents. The likelihood of smoking is 2.8 times higher (OR = 2.856) in the case of both parents smoking compared to the reference variable of non-smoking parents, with other variables unchanged (Hosmer-Lemeshow test, p > 0.999). The model is statistically significant overall ($\chi2$ = 6.754; df = 2; P = 0.034) and explains between 4.7 % (according to Cox & Snell) and 6.3 % (according to Nagelkerke) of the variance in smoking status, correctly classifying 59.7 % of cases (Table 4).

## Discussion

This study aimed to investigate the predictive factors of demographic variables (age, sex, employment, financial status), parental smoking, anxiety, and depression on nicotine dependence and smoking status in young individuals. The findings revealed a high prevalence of smokers in the surveyed group, with as much as 50.4 % of respondents reporting smoking, though with varying intensity. These results exceed the average prevalence in the Republic of Croatia, where approximately one-third of adults are estimated to be smokers. However, the results are lower than those in the student group, indicating a decline in smoking after the student phase [11,12]. Research has shown that approximately 50 % of individuals who start smoking in adolescence continue smoking in later years, suggesting that this is a transitional phase in which only a portion progresses to genuine nicotine dependence, with the proportion of smokers potentially declining in later age [12]. Nevertheless, this result provides insight that this might be one of the key phases when smoking cessation interventions can be implemented to prevent the development of nicotine dependence.

As anticipated, a notably larger percentage of participants smoked if both of their parents smoked, while regression analysis indicated a higher likelihood of youth smoking in the case of both parents smoking. The results align with previous research suggesting that children of smokers are at a higher risk of smoking [24,25,37,38]. The reasons for these results can be diverse. One reason is that the intergenerational transmission of smoking within families is likely influenced by multiple factors, such as genetics, observed parental behaviour, and the home environment (rules about smoking) [39]. Children of smoking parents are more likely to experiment with smoking during adolescence], additionally, children of

smokers tend to have more positive attitudes towards smoking, as parents serve as role models, influencing their children's smoking behaviour by setting an example [40-43]. Moreover, cigarettes are more accessible to children in smoking households compared to those where smoking is not present. Regarding the genetic influences on smoking, parents, and offspring may share genetic traits influencing addiction profiles and responses to nicotine [44,45]. It has been shown that offspring are at a higher risk of developing nicotine dependence from adolescence to early adulthood if their mother has a history of smoking, has been a daily smoker, or is nicotine-dependent [46,47].

Therefore, it is evident that multiple factors influenced by smoking parents can contribute to the initiation of smoking in children. However, it is challenging to determine which factor plays the primary or most significant role. Further detailed analyses of this issue would be crucial to identify factors that could be addressed in prevention efforts. The findings suggest that parental smoking cessation early in their children's lives is critical to prevent habitual smoking in the next generation. However, smoking parents were not found to be associated with the severity of dependence, nor did it prove to be a predictive factor for the severity of dependence in the youth.

Regarding the association with nicotine dependence, only anxiety has been positively correlated with the severity of nicotine dependence. In other words, higher levels of anxiety are associated with more severe nicotine dependence. These results are consistent with the findings of previous studies [48]. Additionally, anxiety has shown a notable positive contribution on the intensity of nicotine dependence in young individuals. These findings align with prior research, although it's essential to acknowledge that certain studies did not focus on a younger demographic [31-34]. Possible explanations for these findings include intriguing mechanisms underlying the connections between various psychiatric diagnoses and persistent nicotine dependence.

Individuals with current anxiety, mood, or personality disorders may seek to alleviate their symptoms by using nicotine, by the release of various neurotransmitters upon the stimulation of nicotinic cholinergic receptors [49,50]. Among these neurotransmitters, dopamine plays a crucial role in signalling pleasurable experiences and is essential for the reinforcing effects of nicotine [51]. The self-medicating process with nicotine could contribute to an elevated risk of persistent nicotine dependence and withdrawal symptoms associated with nicotine [52].

It has also been shown that smoking by one parent significantly contributes to nicotine dependence. Research on this relationship has not been conducted. Possible reasons for parental contribution to the severity of

addiction may lie in the fact that children of smokers are at greater risk of early onset of addiction, while early initiation of smoking has been shown to contribute to later heavier nicotine dependence [53,54]. However, the problem lies in the fact that in this study, it was not defined which parent, mother or father, was involved in smoking. It would be beneficial in future research to investigate whether there is an impact of smoking by a specific parent on nicotine dependence.

The results of this study have provided insight into the factors that can influence smoking behaviour and nicotine dependence and those that can sustain it. By identifying these factors, opportunities for prevention by addressing risk factors are presented. Hence, parental smoking presents a risk for smoking status, while anxiety and smoking by one parent contribute to the severity of dependence. These findings highlight the importance of parental smoking cessation efforts, which are crucial in addressing youth smoking and nicotine dependence. They also provide insight into potential early preventive strategies to reduce or eliminate youth access to cigarettes and prevent addiction development, given that nicotine-dependent smokers encounter challenges in quitting and are more responsive to intensive cessation interventions.

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